

Introduction

Crushed stone and sand and gravel are the main types of natural aggregate used in the United States. Aggregate is used in nearly all residential, commercial, and industrial building construction, and in most public works projects including roads and highways, bridges, railroad and light rail beds, airports, water and sewer systems, and tunnels. Much of the infrastructure built during the 1950s and 1960s has deteriorated to a point that requires extensive repair or replacement. All this construction requires enormous amounts of aggregate. In Colorado, for example, nearly 45 million tons of aggregate, or about 12 tons per person, were produced during 1994.

Aggregate Quality

Aggregate quality is determined by its physical and chemical properties, and is a combination of these two parameters. The quality of the aggregate required for a specific use related directly to that use. For example, to be used in portland cement concrete, aggregate should be both physically satisfactory, and chemically innocuous. However, for use as road base, aggregate commonly only needs to be physically satisfactory; chemical properties commonly are irrelevant.

For this map, potential sources of aggregate are defined according to general physical and chemical quality. Physical quality is defined as satisfactory, fair, or poor. Satisfactory aggregate has physical properties that make it suitable for most purposes. It contains clasts that generally are strong, hard, relatively free from fractures, and not chiplike; capillary absorption is very small or absent; and the surface texture is relatively rough. Fair aggregate has physical properties that make it useful for many purposes, but it commonly can not be used where engineering specifications are strict such as in concrete or asphalt. It contains clasts that generally are friable, moderately fractured, and flat or chiplike; capillary absorption is small to moderate; and the surface is relatively smooth and impermeable. Poor aggregate has physical properties that greatly limit its use. It contains clasts that generally are weak, highly fractured; friable; capillary absorption is moderate to high; and the surface is relatively smooth and impermeable. In many circumstances, potential sources of crushed stone can be processed to improve its quality to meet special requirements.

Chemical quality is defined as either innocuous or deleterious. Innocuous aggregate contains no constituents that dissolve or react chemically to a significant extent that the atmosphere, water, or hydrating portland cement while enclosed in concrete or mortar under ordinary conditions. Deleterious aggregate contains constituents in significant proportion which are known to react chemically under conditions ordinarily prevailing in portland cement concrete or mortar. The reaction may produce significant volume change, interfere with the normal course of hydration of portland cement, or produce other harmful effects upon concrete.

How This Map Was Made

The key to mapping potential sources of aggregate is an understanding of the geology of the region. This includes Quaternary geology for deposits of sand and gravel; stratigraphy, origin, and structural history of the region for crushed stone; and the subsequent weathering or alteration of both sand and gravel deposits or potential sources of bedrock for crushed stone. The Geologic Map of Colorado (Tweto, 1979) serves as a primary source of information for determining the location of potential sources of aggregate.

This map was prepared by attributing the Digital Geologic Map of Colorado - USGS Open File Report 92-0507 (Green, 1992) with parameters reflecting the quality of unconsolidated material and bedrock for use as aggregate (sand and gravel or crushed stone). The terminology and classification techniques used on this map are briefly described above, and are described in more detail in USGS Open File Report 95-582 (Langer and Knepper, 1995).

Use of this Map

Planners and other decision makers responsible for resource management should find this map useful in regional planning and land use management. Because statutory regulations, technological capabilities, available funding, and land-use priorities vary from place to place and can be expected to change with time, this map is designed to provide a resource data base that will be useful over the years. This map is in digital format and can be used with other digital data sets, according to the specific needs of a particular planning issue. As planning criteria change, the selection of pertinent resource characteristics can be adjusted to meet the changing needs.

This map was prepared at a scale of 1:500,000 (2 mm on the map equals 1 kilometer on the ground). The details on the map, as well as the details of the map unit descriptions, are highly generalized. Therefore this map is not intended to replace on-site investigations.

Explanation

Potential sources of sand and gravel aggregate are identified according to their physical properties. Yellow and orange areas are where sand and gravel deposits are likely to be abundant.



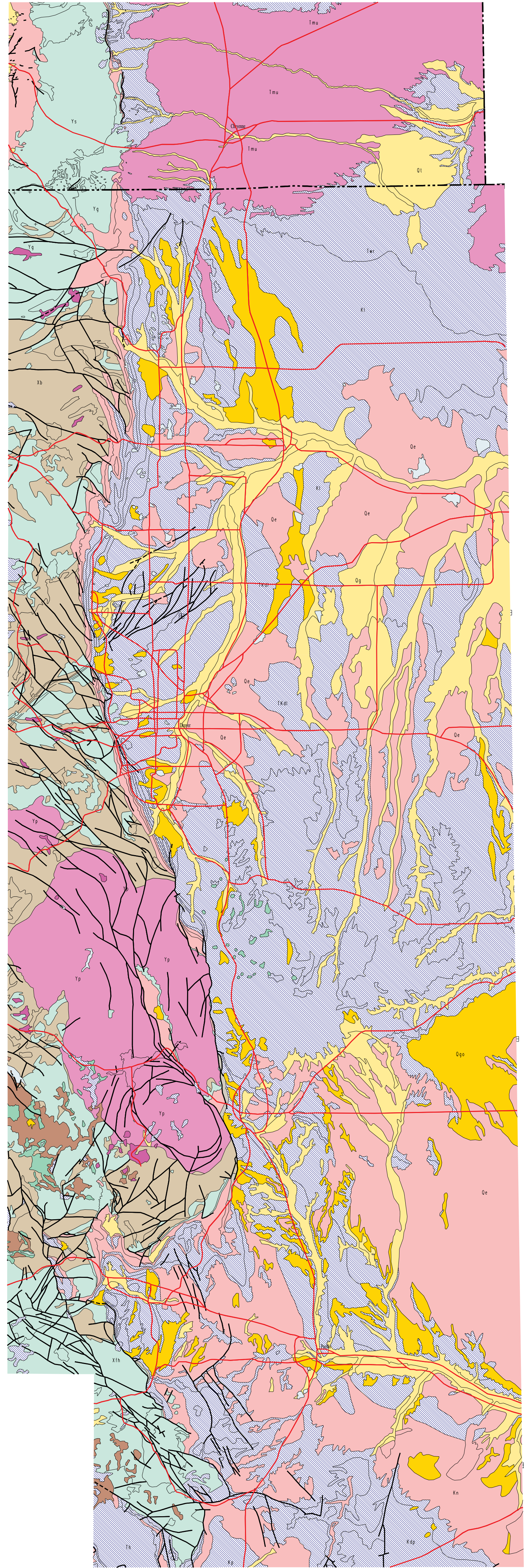
Bedrock may be fractured near geologic faults (thick black lines). This may facilitate aggregate production by reducing the blasting requirements. On the other hand, the rock may be excessively fractured. Fractured pieces of rock have a lower compressive strength than non-fractured rock. Therefore, when using this map to evaluate aggregate resources, aggregate that is shown near faults may be of different quality than indicated.

Other sources of information

Sand and gravel deposits of Quaternary age were attributed using information from Colton and Fitch (1974a) and Trimble and Fitch (1974a,b). An overview of the aggregate industry of Colorado, which focused on the Denver metropolitan area, provides information on rock formations that may be suitable for production of crushed stone (Schwachow, 1980). Maps and descriptions of sources of fire clay (Wagge, 1953) and construction clay (Spence, 1980) were consulted to identify rock formations having potential for other industrial-mineral use.

References cited

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Distribution and Quality of Potential Sources of Aggregate
Infrastructure Resources Project Area, Colorado-Wyoming

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1997

SCALE 1: 500,000

